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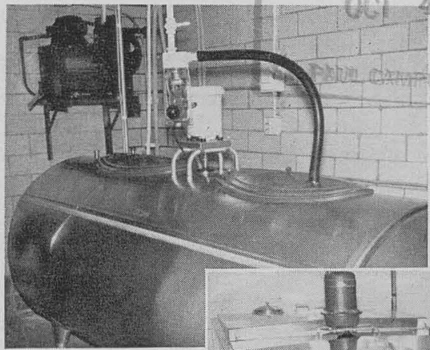
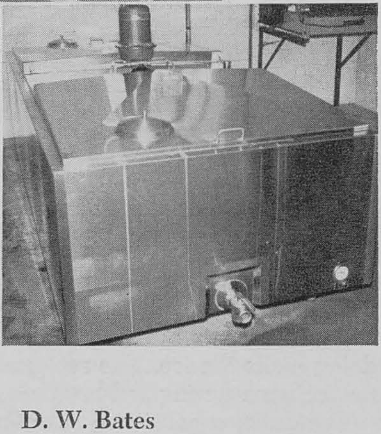
What Kind of BULK MILK COOLER *Should You Buy?*





D. W. Bates

UNIVERSITY OF MINNESOTA
Agricultural Extension Service
U. S. DEPARTMENT OF AGRICULTURE

What Kind of Bulk Milk Cooler Should You Buy?

There are two classes of bulk milk coolers with respect to the cooling systems used—ice bank and direct expansion. The tanks themselves may be of the atmospheric type or the vacuum type.

In considering the differences between the two types of cooling systems, a review of the refrigeration cycle might be helpful.

In a mechanical refrigeration system a refrigerant gas is used. The liquefied gas is stored in a receiver at high pressure. From there it passes through an expansion, or pressure-reducing, valve into an evaporator. As the refrigerant passes through the evaporator it picks up heat from the area surrounding the evaporator. This changes the refrigerant from a liquid to a gas. The gas is then compressed to a high pressure by an electrically driven compressor. From the compressor the gas flows to the condenser, where heat is removed from it and it is liquefied. The liquefied gas then passes to the receiver for storage and the cycle is repeated.

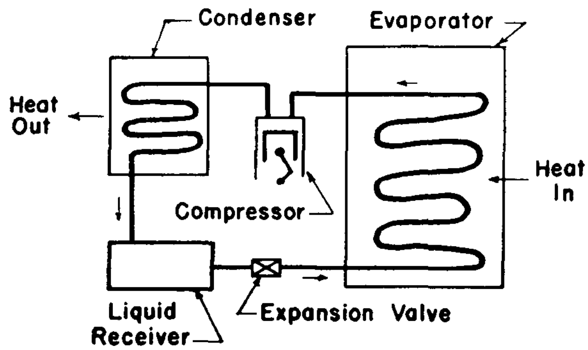
This general principle is used in both the ice-bank and direct-expansion bulk coolers, but the method of cooling the milk is different in each.

With the direct-expansion system the milk is cooled by contact with the evaporator plate or cooling surface. The cooling surface is usually made as an integral part of the bottom of the milk tank. As the refrigerant evaporates it takes heat directly from the milk.

The refrigeration unit thus begins to operate when warm milk enters the tank and continues to operate until the milk is cooled to the desired temperature.

In the ice-bank system, evaporator coils are located in the bottom of the tank beneath the inside liner. As the name implies, a bank of ice builds up around these coils over a period of 8-9 hours. As warm milk enters the tank, water chilled by the ice is circulated around the inner shell of the tank. The cold water removes the heat from the milk and in so doing melts the ice. The refrigeration unit rebuilds the ice bank during and between milking periods.

The direct-expansion system must supply enough refrigeration to cool the milk in a relatively short period of time. Since the ice bank cooler builds up refrigeration during and between milkings, it can do this at a slower rate over a longer period of time.



This is a schematic diagram showing the essential parts of a mechanical refrigeration system.

BULK TANKS MUST MEET 3-A STANDARDS

Bulk tanks for farm use should meet 3-A standards set up by the International Association of Milk and Food Sanitarians, the U. S. Public Health Service, and the Dairy Industry Committee. Among other things, these standards specify that all milk entering the tank must be cooled to 50° F. within the first hour after milking, and to 40° F. by the end of the second hour. Also, the blend temperature must not exceed 50° F. when warm milk is added to cold milk left in the tank from a previous milking.

BULK TANKS HAVE DIFFERENT POWER REQUIREMENTS

Direct-expansion cooling requires about 1 horsepower of compressor motor capacity for each 50 gallons of milk cooled at one milking. Ice-bank cooling requires about $\frac{1}{3}$ horsepower of compressor motor capacity for each 50 gallons of milk cooled at one milking.

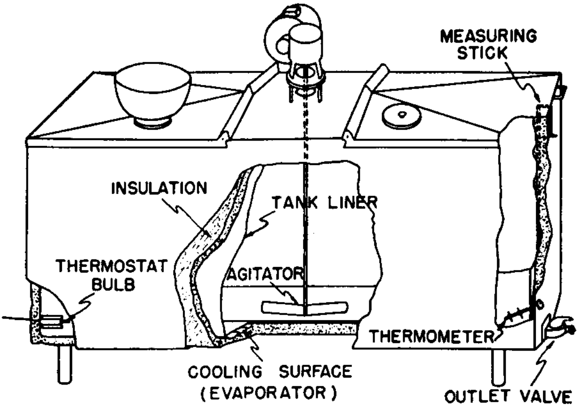
Although direct-expansion cooling requires more horsepower, it cools the milk somewhat more efficiently. Generally about 0.9 kilowatt hour is required for each 100 pounds of milk cooled. Ice-bank cooling requires about 1.3 kilowatt hours per 100 pounds of milk cooled.

In many ice-bank as well as the smaller sizes of direct-expansion coolers, the condensing unit, consisting of the compressor, condenser, and receiver or equivalent, is directly attached to the tank. These units are called "self-contained" or "packaged" units and are usually somewhat easier and cheaper to install. The overall length includes the space required for the condensing unit in addition to that required for the tank.

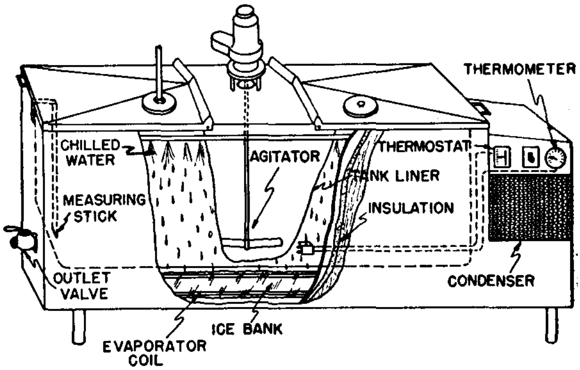
In the larger direct-expansion as well as some ice-bank coolers the tank and the condensing unit are separated. The condensing unit can be away from the tank in a convenient place and it should be 42 inches above the floor. If an air-cooled condenser is located near a wall, provide either a window or louver to admit or exhaust air to cool the condenser during warm weather.

It is not necessary to locate the compressor and the condenser together. In some instances two or more air-cooled condensers are installed at different places. With three condensers, it is possible to release heat outside, in the milkhouse, or in the milking parlor as desired.

Compressor units of 5 horsepower and larger are usually cooled entirely by water. The water consumption may range from 1.5 to 6 gallons per gallon of milk cooled. Disposing of the waste water may be a serious problem. Sometimes part of this water can be used for stock watering.



In a direct-expansion tank, heat is removed from the milk through the evaporator, which is an integral part of the bottom of the tank. The condensing unit is usually located away from the tank.



In an ice-bank tank, water chilled by the ice is sprayed against the tank liner to remove heat from the milk. The condensing unit is usually connected directly to the tank.

VENTILATION IS NEEDED

The efficiency of an air-cooled condensing unit depends upon the temperature of the air moving over the condenser. The cooler the air the more efficient the unit. This applies to combination air- and water-cooled units as well.

In locating a package unit in the milkhouse, be sure to place the tank so there is adequate air circulation around the condenser.

Adequate summer ventilation is essential in the area where an air-cooled condenser operates. Good cross-ventilation provided by screened windows, doors, and louvers may be enough. Natural ventilation of the milkhouse is often relied upon, but in too many cases it is inadequate to carry away the heat released from the condenser. As a result, the temperature in the milkhouse rises. Needless operation of the condensing unit and higher operating costs result.

Dairymen often forget that higher condenser temperatures increase the time needed to provide the necessary refrigeration to cool the milk and consequently increase the cost of operation.

If the condenser is air cooled, it is generally practical to have an exhaust fan in the milkhouse with a capacity of about 450 cubic feet of air per minute per horsepower of the compressor motor. The fan can be wired to operate at the same time as the compressor for summer ventilation. In winter the fan should be shut off, and the heat from the condensor used to help keep the milkhouse warm.

ATMOSPHERIC AND VACUUM TANKS

Apart from the refrigeration system, there are two types of tanks—atmospheric and vacuum. The atmospheric tank is open to the atmosphere and is usually rectangular. The vacuum type is cylindrical to resist atmospheric pressure when a vacuum is drawn on it.

Vacuum tanks are designed to operate with the vacuum of the milking machine. When the vacuum tank is used with a pipeline milker, the milk is drawn directly from the cow into the tank and no releaser is needed in the milk line. However, for cleaning the milk line a releaser or a circulating pump may be needed.

A pour station can also be used. Here the milk is poured into a small stainless-steel container located away from the tank and connected to the tank with a vacuum line through which the milk is drawn. A float in the container rises to open the line when milk is poured in and closes when the container is empty.

WHAT CAPACITY TANK WILL YOU NEED?

Many people have the tendency to buy a bulk tank which is adequate only for the immediate present. Generally, with the convenience of a bulk tank, you will soon find yourself expanding your herd. Purchasing a tank that is adequate only for the present is often a poor investment. A much better long-run investment would be in a tank that may not be used at full capacity for a few years rather than one which will soon be outgrown.

You can determine the size of the tank to buy in two ways. First, by whether the milk is to be picked up every day (ED) or every other day (EOD), and second by the size and production of your dairy herd.

For ED pickup, buy a tank that will hold three milkings during the flush season. For EOD pickup, which is more common, the tank should hold five milkings in the flush season.

Remember that some bulk tanks are designed for ED pickup and can cool one-half of their total capacity at one milking period. Others are designed solely for EOD pickup and can cool only one-fourth of their total capacity at one milking period. The latter type could be used only at one-half capacity on ED pickup.

Before choosing a bulk cooling system, carefully weigh the advantages and disadvantages of each as they apply to your situation. Remember:

1. The reliability of the manufacturer and dealer.
2. The physical dimensions of the tank, if it is to be installed in an existing milkhouse, and the space required around it for cleaning.
3. The attitude of the local power supplier regarding power requirements.

COMPARE THE TWO TYPES OF REFRIGERATION SYSTEMS

Item	Direct-expansion system	Ice-bank system
Purchase and installation cost	Usually higher	Usually lower
Electric energy required	About 0.9 kw.-hr. per 100 pounds milk cooled	About 1.3 kw.-hr. per 100 pounds milk cooled
Size of compressor motor	About 1 hp. per 50 gallons cooled each milking	About $\frac{1}{3}$ hp. per 50 gallons cooled each milking
Compressor operating time, full capacity	4-8 hours daily	16-18 hours daily
Number of motors	3 or 4—compressor, agitator, condenser, cooling fans	4 or 5—compressor, agitator, water-circulating pump, condenser, cooling fans

Wiring requirements	Larger wire and switches, present wiring usually inadequate	Smaller wire and switches, present wiring may be adequate
Power demand	Higher for short period	Lower for longer period
Milk freezing	Can happen	Cannot happen
Type of condenser	Air cooled, water cooled, or combination	Usually air cooled
Water needed to cool condenser	1½-6 gallons per gallon of milk cooled	Usually none
Influence on milkhouse heating	Delivers large amount of heat at milking time, none between milkings	Delivers smaller amount of heat over extended period. Additional heat may not be needed in well-insulated milkhouse
Influence on milkhouse ventilation	Good summer ventilation needed with air-cooled condenser, less with water cooling	Good summer ventilation needed

UNIVERSITY OF MINNESOTA, INSTITUTE OF AGRICULTURE, ST. PAUL 1, MINNESOTA

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